

WHAT IS CLAIMED IS:

- 1 1. A method for inspection of periodic structures on a lithography mask using a microscope
2 with adjustable illumination and an operating element used for movement of a mechanical stage
3 wherein the lithography mask is attached to the mechanical stage in order to record images of the
4 lithography mask at a computer-controlled location on the lithography mask, wherein a position,
5 a size and a pitch specification of the mask are stored, the method comprising:
 - 6 calibrating a first image of each array structure for selected locations on the lithography
7 mask;
 - 8 calculating Fourier coefficients at a reference point of an array/diffraction grating;
 - 9 calculating a residual image from a difference between an original image of the array
10 structure and a Fourier expansion; and
 - 11 forming a threshold value for the calculation of an image indicating an error.
- 1 2. The method of claim 1, wherein the calibrating is carried out by determining a mask
2 rotation and determining a magnification.
- 1 3. The method of claim 2, wherein the determining the mask rotation and the magnification
2 are carried out by numerical optimization wherein a rotation angle and a magnification factor are
3 chosen such that a magnitude of the associated Fourier coefficient is a maximum.
- 1 4. The method of claim 1, wherein a frequency filter is used to reduce curling in the residual
2 image.

1 5. The method of claim 1, wherein the Fourier coefficients are determined and calculated in
2 accordance with an error determination algorithm, the method comprising:

3 measuring the Fourier coefficients of a main position at a large number of points on the
4 mask;

5 converting the Fourier coefficients to a line width value by means of back-transformation
6 and a predetermined intensity threshold value;

7 determining a mean value of an error in a line width by forming an average value over all
8 the measurement points; and

9 rejecting the lithography mask if the error in the line width is greater than the
10 predetermined threshold value.

1 6. The method of claim 5, wherein the determining a mean value of an error comprises:

2 recording each mask position using different focal lengths;

3 measuring the width of the image lines and the image lines' separations by use of Fourier
4 analysis; and

5 determining the error from the defocusing and from the difference between the adjacent
6 intermediate spaces when the error exceeds the predetermined threshold value.

1 7. A method for producing a lithography mask, wherein the method comprises:
2 coating the lithography mask;
3 developing the lithography mask;
4 etching the lithography mask;
5 inspecting the lithography mask, wherein the inspecting comprises calibrating a first
6 image of each array structure for selected locations on the lithography mask, calculating Fourier
7 coefficients at a reference point of an array/diffraction grating, calculating a residual image from
8 a difference between an original image of the array structure and a Fourier expansion, and
9 forming a threshold value for the calculation of an image indicating an error; and
10 repairing the lithography mask based upon results of the inspecting.

1 8. The method of claim 7, wherein the lithography mask comprises a chromium mask.

1 9. The method of claim 7, wherein the lithography mask comprises a half-tone mask.

1 10. The method of claim 7, wherein the lithography mask comprises an interference mask.

1 11. The method of claim 7, wherein the repairing is carried out by means of ion etching.

1 12. The method of claim 7, wherein the repairing is carried out by use of an atom microscope
2 for microprocessing of the lithography mask.

1 13. A method of manufacturing a semiconductor device, the method comprising:
2 manufacturing a lithography mask;
3 inspecting the lithography mask, wherein the inspecting comprises calibrating a first
4 image of each array structure for selected locations on the lithography mask, calculating Fourier
5 coefficients at a reference point of an array/diffraction grating, calculating a residual image from
6 a difference between an original image of the array structure and a Fourier expansion, and
7 forming a threshold value for the calculation of an image indicating an error;
8 forming a resist material over a semiconductor substrate;
9 patterning the resist material using the lithography mask; and
10 effecting the semiconductor substrate based on the patterning.

1 14. The method of claim 13 and further comprising repairing the lithography mask based
2 upon results of the inspecting.

1 15. The method of claim 14, wherein the repairing is carried out by means of ion etching.

1 16. The method of claim 14, wherein the repairing is carried out by use of an atom
2 microscope for microprocessing of the lithography mask.

1 17. The method of claim 13, wherein effecting the semiconductor substrate comprises
2 forming a portion of an array of memory cells.

1 18. The method of claim 13, wherein the calibrating is carried out by determining a mask
2 rotation and determining a magnification.

1 19. The method of claim 18, wherein the determining the mask rotation and the
2 magnification are carried out by numerical optimization wherein a rotation angle and a
3 magnification factor are chosen such that a magnitude of the associated Fourier coefficient is a
4 maximum.

1 20. The method of claim 13, wherein the Fourier coefficients are determined and calculated
2 in accordance with an error determination algorithm, the method comprising:

3 measuring the Fourier coefficients of a main position at a large number of points on the
4 mask;

5 converting the Fourier coefficients to a line width value by means of back-transformation
6 and a predetermined intensity threshold value;

7 determining a mean value of an error in a line width by forming an average value over all
8 the measurement points; and

9 rejecting the lithography mask if the error in the line width is greater than a
10 predetermined threshold value.

1 21. The method of claim 13, wherein the determining a mean value of an error comprises:

2 recording each mask position using different focal lengths;

3 measuring the width of the image lines and the image lines' separations by use of Fourier
4 analysis; and

5 determining the error from the defocusing and from the difference between the adjacent
6 intermediate spaces when the error exceeds the predetermined threshold value.